Astrometric and photometric mass functions of the old open cluster Praesepe from the UKIDSS GCS

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Here we presented the results of a wide field, near–infrared study of the Praesepe cluster using the DR9 of the UKIRT Infrared Deep Sky Survey Galactic Clusters Survey. We performed an astrometric and photometric selection of 1,116 cluster candidates out of the 218,141 point sources detected towards Praesepe.

Possible sources of contamination include Galactic disk late-type and giant stars and unresolved galaxies. We estimate a contamination rate of 11.9 % above 0.4 $M_{\odot}$, 9.8 % in the mass range 0.15–0.4 $M_{\odot}$, and 23.8,% below 0.15 $M_{\odot}$.

We investigated the binary frequency of Praesepe using the photometry and colours from our cluster candidates. We observe a binary fraction similar to the simulation of Bate (2012) between 0.07–0.1 $M_{\odot}$, $\sim$1.5σ difference in the 0.2–0.45 $M_{\odot}$ mass interval, and significantly lower by more than 3σ for the mass range 0.1–0.2 $M_{\odot}$. On the other hand, the binary fraction from Pinfield et al. (2003) are higher than our values and those of Bate (2012). We note that two other works focusing on field low-mass stars have also derived binary fractions lower than Bate (2012).

We also studied the variability of the Praesepe candidates using the two *K*–band epochs provided by the GCS. We identified seven candidate variables, including one in the substellar regime.

We derived the luminosity function of Praesepe in *Z* and *J*–band here. We observed that the peak of the *J*–band luminosity function is one magnitude brighter than the one reported by Boudreault et al. (2010).

Finally, we determined the mass function (MF) of Praesepe, which differs from previous studies: while previous MFs showed an increase from 0.6 to 0.1 $M_{\odot}$, our MF shows a decrease. We looked at the MF of Praesepe at two different regions of the cluster, i.e. within and beyond 1.25°, and we observed that both regions show

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an MF which decreases to lower masses. We compared our MF of Praesepe in the mass range 0.072–0.6 $M_\odot$ with the ones of the Hyades, the Pleiades and α Per. We conclude that our MF of Praesepe is most similar to the MF of α Per although they are respectively of $\sim$85 and $\sim$600 Myr. Even though of similar age, the Praesepe remains different than the Hyades, with a decrease in the MF of only $\sim$0.2 dex from 0.6 down to 0.1 $M_\odot$, compared to $\sim$1 dex for the Hyades. All MFs are presented in Fig. 1.

Acknowledgements SB and NL are funded by national program AYA2010-19136 (Principal Investigator is NL) funded by the Spanish ministry of science and innovation. NL is a Ramón y Cajal fellow at the IAC (program number 08-303-01-02).

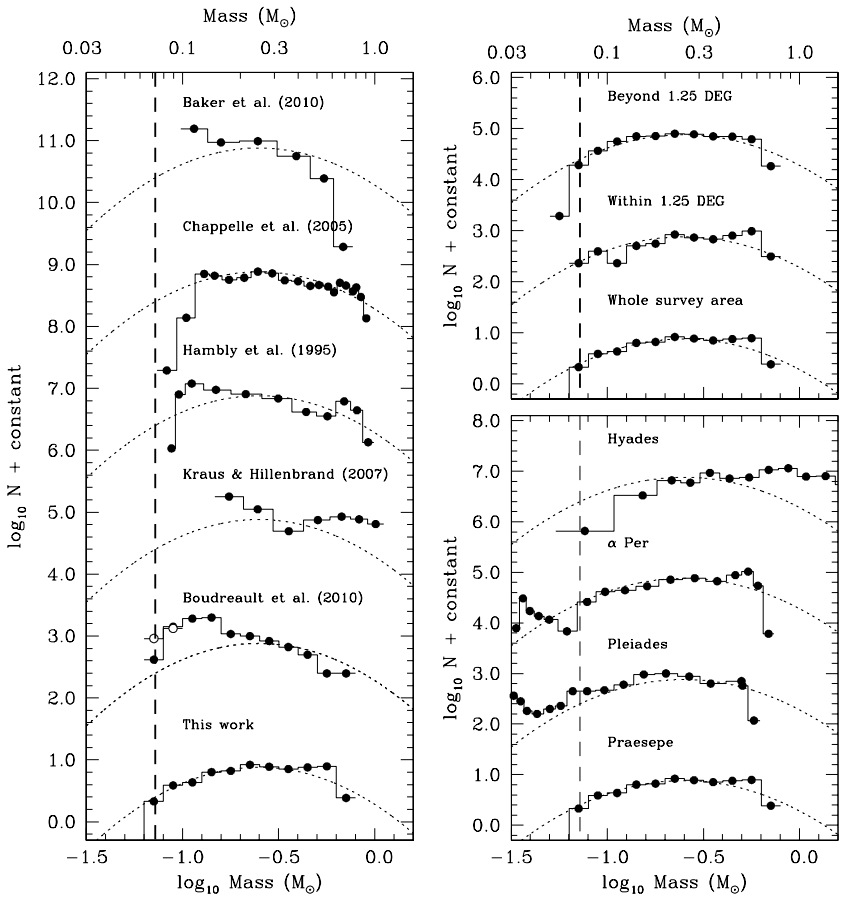

Fig. 1 For all panels, the dotted curved lines is the system Galactic field star MF fit from Chabrier (2005), the vertical dashed line, and the normalization of all the MFs at $\sim$0.3 $M_\odot$ are the same as in. We normalised all the MFs to the log-normal fit of Chabrier (2005) at $\sim$0.3 $M_\odot$ ($\log M \sim -0.5$).